

Health & Safety Manual

Supplement 21.19

Safe Handling of Asbestos-Containing Material During Construction Work

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Approved by the ES&H Working Group

_____ date _____

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Safe Handling of Asbestos-Containing Material During Construction Work*

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Safe Handling of Asbestos-Containing Material during Construction Work

1.0. Introduction

1.1 General

Asbestos refers to a group of six fibrous minerals used in construction materials and other products. Asbestos was used extensively from the turn of the century until recently and thus is present in many LLNL buildings in a variety of products. *Further use of asbestos-containing material (ACM) in LLNL buildings or equipment is generally prohibited.*

Intact ACM is not hazardous unless it is disturbed or the material deteriorates, causing loose fibers to become airborne and respirable. Inhalation of asbestos fibers may increase the risk of developing lung cancer or mesothelioma, a cancer of the lining of the lungs and abdominal area. Inhalation of ACM may also cause asbestosis, a scarring of the lungs. Concurrent exposure to asbestos and cigarette smoke may greatly increase the risk of lung cancer because these two substances act synergistically.

This supplement contains federal requirements and LLNL policy governing asbestos-related work, as well as detailed procedures for carrying such work. Laboratory employees and subcontractors who perform construction work involving asbestos must comply with all requirements in this supplement. Appendix A of this supplement contains terms and definitions; the other appendices provide guidance and supporting material.

1.2 Policy

LLNL has established a Construction-Related Asbestos Control Program to address issues related to asbestos work. The goals of this program are

- To minimize exposure of airborne asbestos dust to employees and visitors.
- To comply with applicable laws, regulations, Department of Energy (DOE) orders, and internal LLNL policy pertaining to asbestos.
- To identify, label, and periodically inspect asbestos-containing building material (ACBM). See Appendix B for a list of common ACBMs.
- To remove, enclose, encapsulate, or repair potentially hazardous ACM. See Appendix B for a list of common ACMs.
- To provide LLNL employees and supplemental labor-only (SLOs) contractors who handle asbestos in construction-related work with appropriate training, equipment, and personal protective equipment (PPE).

- To provide proper industrial hygiene monitoring and referral for medical surveillance if necessary.
- To eliminate the installation of new asbestos-containing items whenever possible.
- To handle untested building materials presumed to be asbestos-containing materials (PACM) as if they contain asbestos until proven otherwise.
- To ensure that subcontracted asbestos work is properly planned, reviewed, and conducted.

2.0 Requirements/Regulatory Summary

2.1 Worker Protection

DOE Order 5480.4 mandates compliance with the Occupational Safety and Health Administration (OSHA) standard (29 CFR 1926.1101) for handling asbestos in construction work. In addition, LLNL must meet the training requirements specified by the Environmental Protection Agency (EPA) under the Asbestos Hazard Emergency Response Act of 1986 (AHERA), 49CFR763, as amended by the Asbestos School Hazard Amendments and Reauthorization Act (ASHARA) of 1990.

Historically, the Laboratory has complied with most of California OSHA health and safety requirements for asbestos that are more restrictive than federal OSHA requirements, except for the administrative requirements for registration and job notification.

2.2 Environmental Protection

The Laboratory is subject to asbestos-handling regulations promulgated by the EPA, the Bay Area Air Quality Management District, and (at Site 300) the San Joaquin Area Air Quality Management District. The State of California asbestos waste-handling requirements are also applicable to asbestos work performed at the Laboratory.

Further information on air quality requirements, environmental protection requirements, and waste handling can be found in the *Environmental Compliance Manual*. A list of applicable health and safety regulations also can be found in Section 8.0 of this supplement.

3.0 Applicability

The requirements in this supplement apply to all Laboratory personnel and subcontractors who perform construction work involving ACM or materials that have not been tested but are “presumed to be asbestos-containing materials” (PACM) (see Appendix A for definition). The operations covered by this supplement include

- Construction activities involving, but not limited to
 - Demolition or salvage of structures where asbestos is present.
 - Removal, enclosure, or encapsulation of materials containing asbestos.
 - Construction, alteration, repair, maintenance, or renovation of structures, substrates, or parts thereof that contain asbestos.
 - Installation of products containing asbestos.
 - Asbestos spills and emergency cleanup.
 - Transportation, disposal, storage, and containment of asbestos or products containing asbestos on the site at which construction activities are being performed.
 - Housekeeping activities involving asbestos or products containing asbestos.
- Sampling of construction or building material to determine the presence of asbestos.
- Inspection of ACBM, as defined in 49 CFR 763 (Building Inspection).
- Planning of ACBM removal, as defined in 49 CFR 763 (Project Design).
- Management of ACM removal.

The requirements in this supplement DO NOT apply to the handling of asbestos in laboratories by researchers, the handling of asbestos-containing materials other than ACBMs (e.g., brake shoes, glassware wrapping), waste processing, or other processes that fall under 29 CFR 1910.1001.

4.0 Controls for Asbestos Work

The handling of ACM present in LLNL facilities may result in exposure to airborne asbestos. Thus, engineering, administrative, and personal protective controls are required to reduce exposure to levels established by regulation and LLNL policy. Engineering controls are the primary means of reducing exposure and are implemented to the extent feasible or necessary. Administrative and personal protective controls supplement engineering controls.

Federal regulation requires asbestos-related construction work to be divided into four categories (see Section 4.1.1) with certain general controls for all categories and specific engineering, administrative, and personal protective

controls for each category. LLNL policy also requires asbestos-related construction work to be further divided into two categories for administrative purposes (see Section 4.1.2).

4.1 Classification of Asbestos Work

4.1.1 OSHA Categories

Class I asbestos work refers to activities involving the removal of thermal system insulation (TSI) and “surfacing ACM,” other than removal required for maintenance activities. Surfacing ACM is material applied to building surfaces “wet” and allowed to dry in place. This includes paints and texturing and joint compounds.

Class II asbestos work refers to activities involving the removal of ACM that is not TSI or surfacing material. This includes, but is not limited to the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.

Class III asbestos work refers to repair and maintenance operations where ACM, including TSI and surfacing material, is likely to be disturbed.

Class IV asbestos work involves maintenance and custodial activities where employees come in contact with ACM as well as activities to clean up waste and debris having ACM.

A summary of the required controls for each category of asbestos work is given in Table 1.

4.1.2 Administrative Categories

LLNL has established two categories of asbestos work for administrative purposes:

1. Limited-scale asbestos work, which includes
 - Class I work involving the removal of less than 25 lineal feet or 10ft² of ACM.
 - Class II work involving less than 500 ft² of ACM.
 - All work involving the removal of vinyl asbestos tiles, regardless of the quantity.
 - All Class III and Class IV work.

Appendix C outlines the process for carrying out limited-scale asbestos work.

2. Large-scale asbestos work, which includes
 - All Class I work involving more than 25 lineal feet or 10 ft² of ACM.
 - Class II work involving more than 500 ft² of ACM, except the removal of vinyl asbestos tile.

A Hazards Control design review is necessary for large-scale asbestos work.

Table 1. Compliance guide for the OSHA Construction Industry Asbestos Standard (29 CFR 1926.1101). Note: Characterize work in accordance with all applicable subcategories, and apply all controls required for all subcategories. Some types of work may not be adequately described in this table.

| Work description | HEPA vac | Wet proc* | Hskg req | Proh Activ ¹ | Reg area ² | Resp. prot | Prot cloth. | NPE | Comp. pers | Critical barriers | Vent. system ³ | Full decon | Mini decon | surface covering | Glove bag | HVAC isol. | Daily monit. ⁴ | Mini-encl |
|---|----------|-----------|----------|-------------------------|-----------------------|----------------|-----------------|-----------------|-----------------|-------------------|---------------------------|-----------------|----------------|------------------|-----------------|------------|---------------------------|------------------|
| All asbestos work | X | X | X | X | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Class I asbestos work | | | | | | | | | | | | | | | | | | |
| Greater than 25 lin. ft or 10 ft ² | X | X | X | X | X | X ⁵ | X | X ⁶ | X ⁷ | X ⁸ | X | X | O | X | X ⁶ | X | X | O |
| Less than 25 lin. ft or 10 ft ² | X | X | X | X | X | X ⁵ | — | X ⁶ | X ⁷ | — | X | O | X | X | X ⁶ | X | X | X ^{6,9} |
| Greater than PEL (TWA or excursion) | X | X | X | X | X | X ⁵ | X | X ⁶ | X ⁷ | X ⁸ | X | X | O | X | X ⁶ | X | X | X ^{6,9} |
| Less than PEL in NEA | X | X | X | X | X | X | O | X ⁶ | X ⁷ | O | X | — | — | X | X ⁶ | X | O | X ^{6,9} |
| No NEA available | X | X | X | X | X | X ⁵ | X | X ⁶ | X ⁷ | X ⁸ | X | X | O | X | X ⁶ | X | X | X ^{6,9} |
| Adjacent area is occupied | X | X | X | X | X | — | — | X ⁶ | X ⁷ | X ⁸ | X | — | — | X | X ⁶ | X | — | X ^{6,9} |
| Outdoors, unoccupied area | X | X | X | X | X | X | X | X ⁶ | X ⁷ | O | X | — | — | X | X ⁶ | X | — | X ^{6,9} |
| Class II asbestos work ^{10,14} | | | | | | | | | | | | | | | | | | |
| Greater than PEL in NEA | X | X | X | X | X | X | X | O ¹¹ | X ⁷ | X ⁸ | X | X | O | X | X ¹¹ | X | X | X ¹¹ |
| Less than PEL in NEA | X | X | X | X | O ¹⁶ | O | O | O ¹¹ | X ⁷ | O | X | O | O | X | X ¹¹ | X | O | X ¹¹ |
| Indoor—No NEA available | X | X | X | X | X | X | X | O ¹¹ | X ⁷ | X ⁸ | X | O | X | X | X ¹¹ | X | X | X ¹¹ |
| Outdoor—No NEA available | X | X | X | X | X | X | X | O ¹¹ | X ⁷ | O ¹⁶ | X | O | X | X | X ¹¹ | X | X | X ¹¹ |
| Removal not intact or dry | X | X | X | X | X | X | — | X ¹² | X ⁷ | X ⁸ | X | O | — | X | X ¹¹ | X | X | X ¹¹ |
| Class III asbestos work | | | | | | | | | | | | | | | | | | |
| Greater than PEL | X | X | X | X | X | X | X | X ⁶ | X ¹³ | X | X | O | X ⁶ | X | X ⁶ | X | O | X ⁶ |
| No NEA available | X | X | X | X | X | X | X | X ⁶ | X ¹³ | X | X | O | X ⁶ | X | X ⁶ | X | O | X ⁶ |
| Dist. TSI or surfacing ACBM | X | X | X | X | X | X | — | — | X ¹³ | X | X | O | — | X | X ⁶ | X | O | X ⁶ |
| Less than PEL in NEA | X | X | X | X | O ¹⁶ | O | O | O | X ¹³ | O | X | O | O | O | O | O | O | O |
| Class IV asbestos work | | | | | | | | | | | | | | | | | | |
| Greater than PEL | X | X | X | X | X | X | X ¹¹ | O | X ¹³ | O | X | O | X | O | O | O | O | O |
| Work in area resp. required | X | X | X | X | — | X | — | O | X ¹³ | — | — | O ¹⁵ | — | — | — | — | — | O |
| Less than PEL in NEA | X | X | X | X | O | O | O | O | O | O | O | O | O | O | O | O | O | O |

* = except for infeasible conditions such as sloped roofs; X = required; O = not required or not allowed; — = not specifically addressed.

¹ Prohibited activity. Includes non-ventilated abrasive disc saw, blow-off, dry sweeping or shoveling, employee rotation.

² Posting is required for all regulated areas.

³ Includes local exhaust and general exhaust, enclosure, and isolation (as feasible or necessary).

⁴ Daily monitoring is usually not required if using supplied air respirators in positive pressure mode (note: does not require pressure demand-type respirator to take this credit).

⁵ Supplied air-pressure-demand respirator with auxiliary escape HEPA or SCBA (>1.0 f/cc) or a PAP respirator with full facepiece and HEPA filters (<1.0 f/cc).

⁶ One of the following control methods must be used: NPE, glove bag, negative-pressure glove bag, water spray, mini-enclosure, or alternative procedures.

⁷ 40-hr training equivalent to EPA project designer or supervisor training.

⁸ Or equivalent, with the requirement to prove the efficacy of the equivalent method. This includes perimeter sampling with 24-hour turnaround. Perimeter levels must meet the AHERA clearance levels.

⁹ Mini-enclosures limited to a “small walk-in chamber that accommodates no more than 2 persons. Mini-enclosures are only to be used for small jobs.

¹⁰ Specific additional requirements are provided for flooring work, roofing, Transite work, and gasket removal. For other Class II work, material must be removed intact unless this is not feasible. Alternative procedures are allowed if exposure is less than the PEL and a competent person certifies the alternative methods are adequate to keep exposure below the PEL at all times.

¹¹ These procedures may be used in lieu of, or in addition to other procedures specified for Class II work.

¹² An NPE is required for the removal of floor tiles if they cannot be removed intact and breaking of the tile creates dust.

¹³ 16-hr training equivalent to EPA O&M training.

¹⁴ Certain roofing activities involving ACM are exempt from Class II category.

¹⁵ Full decontamination facilities must be provided if working in a regulated area where one is required for persons doing other work.

¹⁶ Not required, provided that work is performed in areas where untrained persons do not have access.

Class I asbestos work: Removal of TSI or surfacing ACM or PACM; Class II asbestos work: Removal of ACM that is not TSI or surfacing material (includes floor tiles, shingles, mastics); Class III asbestos work: Repair and maintenance where any type of ACM is likely to be disturbed; Class IV asbestos work: Custodial-type activities that involve contact with ACM and PACM.

4.2 General Requirements

Except as noted, the engineering controls, devices, and work practices that follow apply to all classes of asbestos work regardless of the level of exposure.

Vacuum Cleaners. Vacuum cleaners equipped with high-efficiency particulate air (HEPA) filters shall be used when possible to collect all debris and dust having ACM.

Wet Methods. Wet methods (or wetting agents) shall be used to control employee exposure when handling, mixing, removing, cutting, applying, and cleaning up asbestos—except where the use of such methods is not feasible because they may create electrical hazards, equipment malfunction, and, in roofing, slipping hazards.

Housekeeping. Wastes and debris contaminated with asbestos shall be cleaned up and disposed of promptly in leak-tight containers. ACMs shall be placed in sealed containers as they are removed.

Prohibited Activities. The following engineering controls and work practices shall NOT be used for asbestos-related work, or for work that disturbs ACMs, regardless of the measured levels of asbestos exposure or the results of initial exposure assessments:

- High-speed abrasive disc saws that are not equipped with a point-of-cut ventilator or enclosures with HEPA-filtered exhaust air.
- Compressed air used to remove asbestos or ACM, unless the compressed air is used with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.
- Dry sweeping, shoveling, or other dry cleanup of dust and debris with ACM.
- Employee rotation as a means of reducing employee exposure to asbestos.

Other. All work involving the disturbance of ACM shall be conducted in a manner that minimizes breakage or damage of ACMs; removes ACMs in large segments as is feasible; and complies with any governing Asbestos Work Permit, Operations Plan, safety procedure, or contract document, as applicable. Further details on Asbestos Work Permits (see Appendix D for sample) and Operation Plans can be found in Section 4.13.1.

Fabrics or plastic films used to create enclosures intended for occupancy (or that are capable of being occupied) shall be certified and shall conform to the requirements for large-scale test in the National Fire Protection Agency (NFPA) standard.¹

4.3 Class I—Engineering and Work Practice Controls

4.3.1 Regulated Area

A regulated area must be established for Class I asbestos work. This area

- Serves to isolate the source of asbestos aerosol generation.
- Keeps unprotected personnel away from exposure to the work being performed.
- Demarcates the specific site where asbestos work is conducted, including any adjoining areas where debris and waste from asbestos work accumulate or work areas within which airborne concentrations of asbestos exceed (or may exceed) the permissible exposure limit (PEL). Signs, such as Fig. E-1 of Appendix E, shall be used to demarcate these areas.

A regulated area shall include all areas, as well as adjacent areas occupied by unprotected personnel, where it is anticipated that exposure may occur above the clearance limits specified in Section 4.7.

4.3.2 Competent Person

All Class I asbestos work, including the installation and operation of dust control systems, shall be supervised by a competent person designated by the organization performing the work. A competent person is one who has the qualification, training, and authority to ensure worker safety and health, as required by 29 CFR 1926.20 through 1926.32. Training shall be obtained in a comprehensive course for supervisors (e.g., a course conducted by a certified EPA- or State-approved training provider) or a course equivalent in stringency, content, and length. See Section 6.0 for further details.

4.3.3 Critical Barriers

To prevent fiber migration, critical barriers are required for Class I asbestos work involving the removal of more than 25 linear feet or 10 ft² of TSI or surfacing material; for activities where the employer (LLNL or subcontractor) cannot produce a negative exposure assessment (NEA), as specified in Section 4.7.2; and where unprotected employees are performing work in areas adjacent to the regulated area.

Usually, critical barriers are physical barriers (e.g., plastic sheeting) to dust that separate regulated areas from unregulated areas. Alternatively, another barrier or isolation method (e.g., simply making the regulated area so large that airborne dust does not migrate to the perimeter) that prevents migration of asbestos from the regulated area may be used. The adequacy of this method must be verified by

- Visual surveillance of the perimeter of the regulated area during each work shift to ensure there is no visible asbestos beyond the boundary of the regulated area.

- Monitoring of the perimeter of the regulated area to ensure that asbestos dust levels, as determined by phase contrast microscopy (PCM) or transmission electron microscopy (TEM), do not exceed the corresponding clearance level; or that the perimeter area levels measured by either of these methods are no more than background levels representing the same area before the asbestos work began.

In almost all cases, critical barriers shall be used. Alternative procedures shall only be used when critical barriers are not feasible. Subcontractors shall use physical barriers in all cases where there is a possibility that asbestos may escape from the regulated area and result in exposure to unprotected personnel above the perimeter limits specified in Section 4.7.

The burden of proving the adequacy of alternative dust control methods is substantial. The cognizant Hazards Control industrial hygienist shall review and approve all alternative dust control methods and determine which analytical method shall be used, including the number and location of samples required to verify the adequacy of this method. This is done by means of the Asbestos Work Permit (Appendix D) or Operations Plan. NOTE: These requirements do not imply that perimeter monitoring (see Section 4.7) is not required when critical barriers are used.

Work conducted outdoors (where no unprotected people are in the vicinity of the work) using a specified control procedure need not have critical barriers, visual surveillance, or perimeter monitoring unless such measures are specified by the cognizant Hazards Control industrial hygienist.

4.3.4 Ventilation

For all Class I jobs that do not have an NEA, or where exposure monitoring shows that the PEL has been exceeded, the employer shall ventilate the regulated area to move contaminated air away from the breathing zone of employees toward a HEPA filtration system or other dust-collection device. Where feasible, this shall be done by means of local exhaust ventilation. Alternatively, or in addition, a HEPA-filtered negative-air-pressure, air-filtration exhaust unit (e.g., general exhaust system) may be used.

4.3.5 Contamination Control

Existing heating, ventilation, and air-conditioning (HVAC) systems shall be isolated in regulated areas by sealing with a double layer of 6-mil-thick plastic or equivalent material. An impermeable drop cloth shall be placed on all surfaces where removal activities are conducted. In addition, all objects within the regulated area shall be covered with an impermeable drop cloth or plastic sheeting and secured with duct tape or equivalent material.

4.3.6 Decontamination Areas

A three-chambered decontamination area adjacent and connected to the regulated area shall be established for all large-scale Class I work. It shall consist of

- An equipment room supplied with labeled impermeable bags and containers for containment and disposal of contaminated protective equipment.
- A clean change room equipped with a locker or appropriate storage container for each employee's use.
- Shower facilities that comply with the requirements in 29 CFR 1910.141(d)(3), unless such facilities are not feasible. Showers shall be adjacent to both the equipment room and clean room, unless this is not feasible. The water for the shower should be at least 32°C with a flow rate of at least 10 L/min.

Employees enter and exit regulated areas through the decontamination area. Thus, each room shall be at least 1 m² and 2 m high unless this is not feasible. Below are the steps for entering and leaving a decontamination area:

Entry

1. Enter the decontamination area through the clean room.
2. Remove and deposit street clothing in the locker provided.
3. Don protective clothing and respiratory protection before leaving the clean room.
4. Go through the shower and equipment rooms to enter the regulated area.

Exit

1. Remove all gross contamination and debris from your protective clothing before leaving the regulated area.
2. Remove your protective clothing in the equipment room, BUT DO NOT REMOVE YOUR RESPIRATOR. Deposit the clothing in labeled impermeable bags or containers.
3. Shower with your respirator on before entering the clean room.
4. Take off the respirator and change into your street clothes in the clean room.

Alternate decontamination procedures may be used for limited-scale Class I work. For example, the employer shall establish an equipment room (or area) adjacent to the regulated area or may use mini-enclosures for the decontamination of employees and equipment. The design and work practices for an equipment room and mini-enclosure follow.

Equipment Room/Area

Design

- The room must be of sufficient size to accommodate cleaning of the equipment and removal of PPE without spreading contamination beyond the area. This can be achieved by covering the floor or horizontal working surface with an impermeable drop cloth.

Work practices

- Work clothing must be cleaned with a HEPA vacuum prior to removal.
- All equipment and surfaces of containers filled with ACM must be cleaned prior to removal from the equipment room (or area).
- The employer shall ensure that employees enter and exit the regulated area through the equipment room (or area).

Mini-enclosure. A small walk-in enclosure (mini-enclosure) that can accommodate no more than two persons may be used for limited-scale work if the material disturbed or removed can be completely contained by the enclosure. The design and work practices for this enclosure are as follows:

Design

- Fabricated or job-made enclosures shall be constructed of 6-mil-thick plastic or equivalent.
- The enclosure shall be placed under a negative pressure (at least 0.02-in. water gauge is recommended) by means of a HEPA-filtered vacuum or an equivalent ventilation unit.

Work practices

- The enclosure shall be inspected by a competent person for leaks before use and smoke tested for breaches. Any breaches shall be sealed. The project inspector shall perform this inspection for subcontracted work.
- The interior of the enclosure shall be completely washed with amended water before use and cleaned with a HEPA vacuum.
- Air movement within the enclosure shall be directed away from the employee's breathing zone.

4.3.7 Control Systems

There are five OSHA-approved dust-control systems for Class I asbestos work:

1. Negative pressure enclosures (NPE).
2. Glove bags.
3. Negative pressure glove bags.
4. Negative pressure glove boxes.
5. Water spray systems. These systems shall not be used unless described in detail in an operational safety procedure (OSP), Operation Plan, or contract submittal, and approved by the cognizant Hazards Control industrial hygienist.

These controls are used in addition to the general controls (critical barriers or equivalent) required for all asbestos work.

Negative Pressure Enclosure

Design

- NPEs may be of any configuration.
- At least 4 air changes (6 recommended) per hour shall be maintained in NPEs.
- A minimum of -0.02 column in. of water pressure differential (-0.05 column in. recommended), relative to outside pressure, shall be maintained within NPEs as evidenced by continuous manometric measurements with a continuous data-recording system.
- NPEs shall be kept under negative pressure throughout the period of use and until acceptable clearance sample results are obtained.
- Air movement shall be directed away from employees performing asbestos work within the enclosure toward a HEPA filtration system.
- Back-up air filter units and an emergency generator should be staged onsite for all large-scale Class I (and II) work performed in NPEs. Back-up units shall be of a size that will maintain a negative pressure of at least 0.01-in. water gauge during failure of the primary system. In addition, back-up units shall be tested before work begins and staged such that they can be brought on-line within 15 minutes of a power or fan failure. An "emergency power" system that automatically triggers the generator in the event of a power failure should be considered where there is a significant possibility of contamination of occupied adjacent areas.

Work Practices

- NPEs shall be inspected by a competent person for breaches and smoke tested for leaks before beginning work and at the beginning of each work shift. The project inspector or a consulting industrial hygienist shall perform this inspection for subcontracted work.
- Electrical circuits in the enclosure shall be deactivated, unless equipped with ground-fault circuit interrupters (GFCIs).

Glove Bags

Design. Glove bags shall be made of 6-mil-thick plastic (or equivalent approved by the cognizant Hazards Control industrial hygienist) and shall be seamless at the bottom.

Work Practices

- Glove bags may be used to remove ACM from piping. Each glove bag shall be installed so that it completely covers the circumference of the pipe or other structure where the work is being performed.

- Glove bags shall be smoke tested inside the bags for leaks, including sealed leaks, before use.
- Glove bags may be used only once and may not be moved.
- Glove bags shall not be used on surfaces whose temperature exceeds 150°.
- Prior to disposal, glove bags shall be collapsed by removing the air from within with a HEPA vacuum.
- Before beginning the operation, loose and friable material adjacent to the glove bag (or glove box) shall be wrapped and sealed in two layers of 6-mil-thick plastic or otherwise rendered intact. Friable material is any material that can be reduced to a powder by applying hand pressure.
- Waste bags attached to glove bags shall be connected to a collection bag using a hose or other material that can withstand the pressure of the ACM waste and water without losing their integrity. A sliding valve or other device shall separate the waste bag from the hose to ensure there is no exposure when the waste bag is disconnected.
- At least two persons shall remove glove bags.
- The length of a glove bag should not exceed 2 m.
- The cognizant industrial hygienist may prohibit the use of multiple glove bags in series or in areas where their removal may disturb more than 10 lineal feet of asbestos-containing pipe insulation.

Negative Pressure Glove Bag Systems. These systems may be used to remove ACM piping and fittings.

Design

- In addition to the specifications for glove bags, negative-pressure glove bag systems shall include a HEPA vacuum (or other device) so that they are under a constant negative pressure of at least 0.02-in. water gauge. A means must be provided to prevent the bag from collapsing during removal.

Work Practices

- The HEPA vacuum (or other device) shall run continually during the operation.
- When a collection bag is used along with a separate waste bag that is discarded after one use, the collection bag may be reused if it is rinsed clean with amended water.

Negative Pressure Glove Boxes. These glove boxes may be used to remove ACM from pipe runs.

Design

- Glove boxes shall be constructed with rigid sides; they shall be made of metal or other material that can withstand the weight of the ACM and water used during removal of the material.

- A HEPA-filtered vacuum or other negative-pressure generator shall be used to create a negative pressure of 0.02 in. or more water gauge in the system.
- An air filtration unit shall be attached to any air inlet on the glove box.
- The glove box shall be fitted with gloved apertures.
- An aperture at the base of the box shall serve as a bagging outlet for waste ACM and water.
- A back-up generator shall be present onsite and be of such a size that it can operate the negative-pressure system within 5 minutes of a power failure.
- Waste bags shall consist of 6-mil-thick plastic (or thicker) and double-bagged before they are filled.

Work practices

- At least two persons shall conduct work in negative-pressure glove boxes.
- Glove boxes shall be smoke tested before each use.
- Loose or damaged ACM adjacent to the glove box shall be wrapped and sealed in two layers of 6-mil-thick plastic before work begins, or otherwise rendered intact.

4.3.8 Alternative Controls for Class I Work

Class I work may be performed using controls other than those discussed in this supplement if the following provisions are met:

- The alternate control method encloses, contains, or isolates the processes or source of airborne asbestos dust, or otherwise captures or redirects such dust before it enters the breathing zone of employees.
- An industrial hygienist qualified to evaluate the work area, the projected work practices, and the engineering controls certifies in writing that the alternate method
 - Is adequate to reduce direct and indirect employee exposure below the PELs under worst-case conditions of use.
 - Will prevent asbestos contamination from exceeding the clearance level outside the regulated area.

A Hazards Control industrial hygienist shall conduct the evaluation for work performed by LLNL or SLO employees. Subcontractors who use an alternative procedure shall retain a Certified Industrial Hygienist to perform the evaluation and submit it to a cognizant Hazards Control industrial hygienist for review and approval.

- The evaluation of TSI (25 linear ft or 10ft² or less) or surfacing material (10 ft²) to be removed may be performed or reviewed by any Hazards Control industrial hygienist. Perimeter or clearance monitoring otherwise required may be omitted.

4.4 Class II—Engineering and Work Practices Controls

Class II asbestos work may be performed using one of the control systems (see Section 4.3.7) allowed for Class I asbestos work. Glove bags and glove boxes are allowed only if they fully enclose the material to be removed. The requirements below as well as the general requirements in Section 4.2 are applicable to Class II asbestos work.

4.4.1 Asbestos Work Permits, Operation Plans

The current version of the National Institute of Building Sciences (NIBS) specifications² may be used as a starting point for developing Asbestos Work Permits and Operation Plans. Asbestos Work Permits and Operation Plans are further described in Section 4.13.

4.4.2 Regulated Area

A regulated area must be established for Class II asbestos work, unless the work is covered by an NEA and is not generally accessible to unprotected people. The guidelines for establishing and demarcating a regulated area for Class II work are the same as those described in Section 4.3.1 for Class I work.

4.4.3 Competent Person

All Class II asbestos work shall be supervised by a competent person, as described in Section 4.3.2.

4.4.4 Critical Barriers

Critical barriers are required for all indoor Class II asbestos work where one of the following applies:

- There is no NEA.
- Conditions change during the job and there is an indication that exposure may be above the PEL.
- The ACM is not removed intact.

To ensure that airborne asbestos does not migrate from the regulated area, either place critical barriers over all openings of the area or use another barrier or isolation method. Other methods are discussed in Section 4.3.3.

4.4.5 Contamination Control

An impermeable drop cloth shall be placed on all surfaces that may become contaminated when performing removal activities involving Class II asbestos.

4.4.6 Decontamination Areas

Any Class II work that is known to result in exposure above the PEL shall be provided with a three-chambered decontamination system, if feasible. Class II asbestos work for which there is no NEA should be provided with either a three-chambered decontamination system or an equipment room, as determined by the cognizant industrial hygienist. The design and work

practices for the equipment room for Class II work, including procedures for entering and leaving the decontamination area, are the same as those described in Section 4.3.6 for Class I work.

4.4.7 Removal of Materials with ACM

Floor Tiles. Employees shall comply with the work practices below when removing vinyl and asphalt flooring materials that contain ACM.

- Flooring or its backing shall not be sanded.
- Vacuums equipped with HEPA filters, disposable dust bags, and metal floor tools (no brush) shall be used to clean floors.
- Linoleum sheeting shall be removed by cutting, wetting of the snip point, and wetting during delamination. DO NOT “rip up” resilient sheeting or flooring material.
- All scraping of residual adhesive and/or backing shall be performed using wet methods.
- Dry sweeping is prohibited. Instead, dry HEPA vacuuming shall be used.
- Mechanical chipping is prohibited unless performed in an NPE. Any procedure that requires breaking the tile, creating visible or measurable asbestos-containing dust in air, is considered mechanical chipping.
- Tiles shall be removed intact whenever possible. Wetting may be omitted when tiles are heated and can be removed intact.
- Resilient flooring material, including associated mastic and backing, shall be assumed to be asbestos-containing unless an industrial hygienist or qualified building inspector determines that the material is asbestos free by means of microscopic analysis.

NOTE: When vinyl asbestos floor tiles containing no more than 5% chrysotile asbestos are removed intact by personnel appropriately trained and supervised to do Class II asbestos work, it can be assumed that exposure will not exceed the permissible exposure limit.

Roofing. Employees shall comply with the work practices described below when removing roofing material with ACM.

- Roofing material shall be removed intact to the extent feasible.
- Wet methods should be used where feasible. The use of wet methods is not required for roof removal if the ACM is removed intact, exposure does not exceed the PEL, and if wetting will create a substantial slipping hazard. Wet methods are required, to the extent that the procedure does not create a slipping hazard, when cutting machines are used and the material is not removed intact.
- All loose dust from sawing operations must be HEPA vacuumed immediately. Where built-up smooth (non-graveled) roofing is

removed using a power cutter, dust may be wet-swept rather than HEPA vacuumed.

- Wet methods or HEPA vacuuming is not required to remove or repair less than 25 ft² of roofing material, if the material remains intact and does not generate visible dust.
- Cutting machines shall be continuously misted during use, unless a competent person determines that misting substantially decreases worker safety.
- All loose dust from sawing operations must be HEPA vacuumed immediately.
- Roof-level heating and ventilation air-intake sources shall be isolated or the ventilation system shall be shut down.

The removal of asbestos-containing roofing cements, mastics, coatings, and flashings is not classified as Class II work if such materials are non-friable at the start; are not sanded, abraded, or ground; and are removed using manual methods that do not degrade the material. A competent person must determine if the materials are intact and will remain so during removal. Removal of the such materials must be conducted by people trained to perform Class II or Class III asbestos work.

Asbestos Cement Panels. The work practices described below are applicable when removing cementitious asbestos-containing siding, shingles, or Transite panels with ACM.

- Cutting, abrading, or breaking of siding, shingles, or Transite panels shall be prohibited unless the employer can demonstrate that other methods less likely to result in asbestos fiber release cannot be used.
- Each panel or shingle shall be sprayed with amended water prior to removal.
- Unwrapped or unbagged panels or shingles shall be lowered to the ground immediately via a covered, dust-tight chute (crane or hoist), or placed in an impervious waste bag, or wrapped in plastic sheeting and lowered to the ground no later than the end of the work shift.
- Nails shall be cut with flat, sharp tools.

Gaskets. The following work practices apply when removing gaskets containing ACM:

- If a gasket is visibly deteriorated and cannot be removed intact, removal shall be undertaken within a glove bag or glove box.
- The gasket shall be wet thoroughly with amended water prior to removal and immediately placed in a disposal container.
- Any scraping to remove residue must be performed using wet methods.

4.4.8 Alternative Controls for Class II Work

Controls different from those described in this supplement or modified engineering and work practice controls may be used if the following provisions are met:

- The organization planning the work demonstrates by data representing employee exposure that, during the use of such method, employee exposure will not exceed the PEL under any anticipated circumstances.
- An industrial hygienist qualified as a project designer (see Section 6.0 for criteria) (or someone under his/her direction) evaluates the work area, the projected work practices, and the engineering controls and certifies in writing that the alternate method
 - Is adequate to reduce direct and indirect employee exposure below the PEL under worst-case conditions of use.
 - Will prevent asbestos contamination from exceeding the clearance level outside the regulated area.

A Hazards Control industrial hygienist shall perform the evaluation for work done by LLNL or SLO employees. Subcontractors who use an alternative procedure shall retain a Certified Industrial Hygienist (or competent person) to perform the evaluation and submit it to the cognizant Hazards Control industrial hygienist for review and approval.

4.5 Class III—Engineering and Work Practices Controls

4.5.1 Asbestos Work Permits, Operation Plans

The current version of the National Institute of Building Sciences (NIBS) specifications² may be used as a starting point for developing Asbestos Work Permits and Operation Plans. Asbestos Work Permits and Operation Plans are further discussed in Section 4.13.

4.5.2 General

The requirements below, including those in Section 4.2, are applicable to Class III asbestos work. Where there is no NEA for a job, or where monitoring results of the NEA show that the PEL has been exceeded, workers shall contain the area using an impermeable drop cloth and plastic sheeting (critical barriers) or equivalent. A glove bag, glove box, mini-enclosure, or NPE may also be used. In addition, the employer shall establish an equipment room (or area) adjacent to the regulated area for the decontamination of employees and equipment. The design and work practices for the equipment room for Class III work are the same as those described in Section 4.3.6 for Class I work.

4.5.3 Regulated Area

A regulated area must be established for Class III asbestos work. However, it is

not required for Class III work for which there is an NEA if the work is performed in areas where untrained personnel do not have any access. The guidelines for establishing and demarcating a regulated area for Class III work are the same as those described in Section 4.3.1 for Class I work.

4.5.4 Competent Person

All Class III asbestos work must be supervised by a competent person. The training for a competent person in this case can be a 16-hour maintenance and operations course that meets the requirements of 49 CFR 763.

4.6 Class IV—Engineering and Work Practices Controls

4.6.1 Asbestos Work Permits, Operation Plans

The current version of the National Institute of Building Sciences (NIBS) specifications² may be used as a starting point for developing Asbestos Work Permits and Operation Plans. Asbestos Work Permits and Operation Plans are further discussed in Section 4.13.

The requirements below, including those in Section 4.2, are applicable to Class IV asbestos work.

4.6.2 Regulated Area

Class IV asbestos work shall be conducted in a regulated area if exposure above the PEL is anticipated.

4.6.3 Decontamination

Where Class IV work involves the cleanup of ACM debris, the employer shall establish an equipment room (or area) adjacent to the regulated area for the decontamination of employees and equipment. The design and work practices for the equipment room for Class IV work are the same as those described in Section 4.3.6 for Class I work.

4.7 Administrative Controls

4.7.1. Airborne Exposure Limits

Personal Exposure Limits. Personnel involved in asbestos-related work shall not be exposed to an 8-hour, time-weighted-average (TWA) airborne asbestos level exceeding 0.1 fibers per cubic centimeter of air (f/cc), as determined by phase contrast microscopy (PCM) and in accordance with the OSHA reference method (the PEL); or 1.0 f/cc averaged over any half-hour period, as determined by PCM (the excursion limit). All persons assigned to conduct Class I asbestos-related work shall be assumed to be potentially overexposed to airborne asbestos until specific monitoring demonstrates otherwise. Thus, all the requirements for air monitoring, PPE, medical surveillance, and training must be met before one is assigned to Class I asbestos-related work. All exposure-monitoring data for these individuals will be provided to Health

Services.

Clearance Limits. The acceptable clearance level of asbestos for all samples in the area analyzed using PCM shall be less than 0.1 f/cc or a lower fiber concentration than that which existed before the start of the asbestos work, as determined by the cognizant Hazards Control industrial hygienist. This analysis shall be done in accordance with the 7400 method³ or the most recent OSHA analytical method.⁴

If TEM analysis is used, the clearance level for samples shall be a mean value of less than 0.02 asbestos structures per cubic centimeter of air, which is statistically equal to (or less than) the mean of the results of baseline samples or statistically indistinguishable from concurrent outside sample results, as determined by the cognizant Hazards Control industrial hygienist. This analysis shall be done in accordance with the AHERA method⁵ or Yamate level 2 method.⁶ All asbestos structures greater than 0.5 μm shall be tabulated.

Incidental Exposure. Incidental exposure to asbestos (such as background levels in work areas or exposures to individuals not directly involved with asbestos work) should not exceed the clearance criteria previously described. If air sampling indicates excessive exposure, the industrial hygienist should notify management, identify the source of the asbestos, and determine the appropriate action.

4.7.2 Air Monitoring Program

Exposure to airborne asbestos for individuals performing asbestos-handling work must be determined by personal air sampling in accordance with the OSHA analytical method,⁴ or an equivalent PCM procedure. Hazards Control will characterize asbestos exposure for LLNL employees or SLO personnel who perform limited-scale work. For all subcontracted and large-scale asbestos work (i.e., Class I asbestos work that disturbs 25 lineal feet or 10 ft² of ACM or Class II work, other than floor tile, exceeding 500 ft²), the organization performing the work shall retain an industrial hygienist to characterize employee exposure to asbestos as required by Plant Engineering specifications.⁷ The cognizant industrial hygienist may provide this service for Plant Engineering personnel who perform large-scale work, if time permits.

Initial Exposure Monitoring. Either a Hazards Control industrial hygienist or an industrial hygienist certified by the American Board of Industrial Hygiene in the comprehensive practice of industrial hygiene shall conduct initial sampling to accurately assess 8-hour TWA and 30-minute excursion exposures, as appropriate.

Negative Exposure Assessment Criteria. For any asbestos job that will be performed by employees trained in compliance with this supplement, it may be possible to demonstrate that employee exposure will not exceed the PEL.

Objective data must show that the product or material containing asbestos minerals, or the activity involving such product or material, cannot release airborne fibers in concentrations exceeding the TWA and excursion limit under work conditions having the greatest potential for releasing asbestos. Where prior asbestos jobs have been monitored for the PEL and excursion limit within 12 months of the current or projected job, employers (LLNL or subcontractor) must show that

- The monitoring and analysis were performed in compliance with the asbestos standard in effect.
- The data were obtained during work operations conducted under workplace conditions "closely resembling" the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the employer's current operations.
- The operations were conducted by employees whose training and experience are no more extensive than that of individuals performing the current job.
- There is a high degree of certainty employee exposures will not exceed the TWA and excursion limit under the conditions prevailing in the current workplace.
- Initial air sampling included monitoring during that portion of the entire asbestos job which is most likely to result in exposure above the 8-hour TWA exposure or 30-minute excursion limit (i.e., the data are worst case).

Only Hazard Controls industrial hygienists are permitted to accept a determination of negative exposure. Generally, NEAs will be developed by Hazards Control for LLNL employees and SLO employees. Subcontractors must submit complete documentation of any NEA to the cognizant industrial hygienist for review. Inadequate NEAs shall not be used for work performed at LLNL.

Periodic Monitoring. Unless an NEA for the entire operation has been developed and accepted by Hazards Control, daily monitoring representative of the 8-hour TWA or 30-minute excursion limit shall be conducted for employees who perform Class I and Class II work and are assigned to work within a regulated area. Periodic monitoring shall be conducted for all operations (except Class I and II) at intervals sufficient to document the validity of the exposure prediction where exposures are expected to exceed the PEL. Monitoring shall be conducted at least annually for these operations.

An exemption from daily personnel sampling is provided if the individuals performing the work wear continuous-flow, type-C supplied air respirators.

The cognizant industrial hygienist shall provide written notification to the supervisors of LLNL and SLO personnel monitored soon after receiving the air sampling results. If the PEL or excursion limit has been exceeded,

notification shall include requirements for medical surveillance and the steps necessary to reduce the airborne asbestos levels. A copy of the notification shall be provided to Health Services. The contractor shall submit the results of air sampling work conducted by subcontractors to the University, as required by Plant Engineering specifications.⁷ All results shall be reported regardless of the protection afforded the affected employee(s) by the respirator in use.

Perimeter Sampling. Perimeter sampling shall be conducted around each regulated area, which, in the event of a failure of asbestos controls, has the potential to expose unprotected personnel to asbestos above the clearance level specified in this supplement. (The limits for airborne asbestos at the perimeter of an asbestos work area are the same as the clearance sample limits.) The frequency, sampling, and analysis procedure shall be determined by the cognizant Hazards Control industrial hygienist and indicated on the Asbestos Work Permit (Appendix D) or Operation Plan, or in the contract specifications for subcontracted work. Hazards Control conducts perimeter sampling for LLNL or SLO employees who perform limited-scale work. Alternatively, the organization conducting large-scale work is responsible for obtaining a Certified Industrial Hygienist to conduct perimeter sampling. If time permits, the cognizant industrial hygienist may provide this service for Plant Engineering personnel who perform large-scale work.

A copy of the results (with an interpretation) of perimeter samples taken for each occupied or reoccupied area shall be provided to the building coordinator within 15 days of receipt. The building coordinator shall communicate these results to individuals who occupy the affected area of the building.

Clearance Sampling. Clearance samples are used to document the adequacy of decontamination and cleanup after asbestos work. Clearance samples shall be collected (where technically feasible) after all indoor, large-scale, and limited-scale asbestos work; after performing Class I or Class II work that does not have an NEA; and for activities deemed appropriate and feasible by the industrial hygienist. Clearance sampling is not usually required for Class III, Class IV, or outdoor asbestos work. In some cases, however, the cognizant industrial hygienist may determine that sampling may be appropriate after performing Class III or outdoor asbestos work. Clearance sampling may not be appropriate or feasible after performing glove bag or glove box work in low-occupancy areas such as machine rooms.

Clearance samples collected may be analyzed using either the PCM or TEM method. Generally, PCM analysis will be used. TEM analysis equivalent to the OSHA analytical method⁴ or Yamate level 2 method⁶ will be used for

- Class I asbestos work that disturbs more than 25 lineal feet or 10 ft² of ACM.
- Class II asbestos work, excluding floor tile, involving more than 500 ft²

of ACM.

- Class II asbestos work involving more than 150 ft² of floor tile.

Hazards Control shall conduct sampling for LLNL employees and SLO personnel who conduct limited-scale work. Alternatively, the LLNL organization performing or subcontracting large-scale asbestos work must retain the services of a Certified Industrial Hygienist to conduct clearance sampling. The cognizant Hazards Control industrial hygienist may provide this service for Plant Engineering personnel who perform large-scale work if time permits.

Clearance sampling shall be conducted using “aggressive techniques” when technically appropriate and in accordance with the procedure described in 40CFR 763(E). Clearance samples shall only be collected after the area has passed a rigorous visual inspection, and where it has been verified that all potentially asbestos-containing dust and debris have been removed. Critical barriers and negative pressure shall be maintained until acceptable results of the clearance samples are obtained.

The cognizant Hazards Control industrial hygienist shall determine the number of clearance samples to be collected. As a minimum, at least one sample shall be collected for each discrete work area. The required number of samples and analysis procedures shall be specified in subcontracting specifications.

Other Sampling. At the discretion of the industrial hygienist, personal, area, or other types of samples may be collected in occupied areas believed to be contaminated with airborne asbestos. The sampling and analytical method used in these cases shall be determined by the industrial hygienist. A copy of the results (with an interpretation) of hazard assessment samples obtained for each occupied area shall be provided to the building coordinator within 15 days of receipt. The building coordinator shall communicate these results to individuals who occupy affected areas of the building.

Selective Fiber Counting. All fibers meeting the OSHA size criteria⁴ (>5 µm in length, 3:1 aspect ratio) shall be counted whenever analysis is performed by PCM, unless the cognizant industrial hygienist determines that selective fiber counting is warranted and a laboratory with the necessary skills is available to perform the analysis. The use of optical microscopy for selective fiber counting is not permitted for samples collected by consultants or contractors, unless approved by the cognizant Hazards Control industrial hygienist.

4.7.3 Medical Surveillance

Medical surveillance is intended to identify and evaluate employees who are at special risk with regard to asbestos work, to facilitate early detection of asbestos-related conditions, and to assess an employee’s ability to wear a respirator. Medical surveillance shall be provided to all employees who

- Engage in Class I, II, or III work for a combined total of 30 days or more

a year. (Work lasting less than one hour a day is not to be included in the 30 days.)

- Are exposed at or above the PEL or excursion limit.
- Wear negative-pressure respirators for protection against asbestos for more than 30 days a year. (Days when exposure is less than 1 hour are not to be counted toward the annual total of 30 days for the purpose of medical surveillance.)
- Are required to wear negative-pressure respirators for protection against asbestos.
- Have had a significant occupational work history, as determined by a Health Services clinician.

The supervisor of any employee who might require medical surveillance under the criteria described above shall contact the area ES&H team industrial hygienist and arrange for a hazard assessment. Hazards Control shall conduct hazard assessments for LLNL and SLO employees, document cases where medical surveillance is required, and provide written notification to the supervisor of the affected employee(s). For LLNL employees, a copy of all notifications shall be sent to Health Services. SLO employers will receive copies of the notification and are then responsible for providing medical surveillance for their employees.

Depending on the results of the hazard assessment, the supervisor shall either contact Health Services immediately to schedule the employee (University employees only) for a baseline examination or notify the appropriate supplemental labor site representative. In addition, the supervisor shall provide Health Services or the SLO subcontractor representative with a description of the employee's job duties and the PPE the employee used when handling asbestos. A copy of the air-sampling results and/or hazard assessment shall be sent to Health Services or the SLO site representative, as appropriate.

Exams shall be performed by or under the supervision of a licensed physician and at no cost to the employee. The content of these exams must comply with the requirements in 29 CFR 1926.1101(m). Baseline exams shall be provided to employees prior to assignment in areas where the use of negative-pressure respirators are required for more than 30 days a year, and to employees who are exposed above the PEL within 10 working days of the thirtieth day of the year. Annual re-examinations shall be offered to all personnel who will have baseline exams for the remainder of their employment at LLNL.

Health Services shall provide employees and their supervisors a written opinion of the results of medical exams.

Additional provisions of the Medical Surveillance Program can be found in 29CFR 1926.1101.

4.8 Personal Protective Equipment

4.8.1 Respiratory Protection

Respirators shall be used during emergencies, regardless of exposure, and for

- All Class I asbestos work.
- All Class II work where the ACM is not removed in a substantially intact state.
- All Class II and III work that is not performed using wet methods, except the removal of ACM from sloped roofs where wetting creates a slipping hazards.
- All Class II and III work performed without an NEA.
- All Class III work where TSI or surfacing ACM will be disturbed, unless an NEA is available for the work.
- All Class IV work performed within regulated areas, where employees performing other work are required to wear respirators.
- All work specified in this section where employees are exposed above the TWA or excursion limit.

Table2 gives the criteria for selecting the appropriate respirator.

Table 2. Selection criteria for respirators.

| Airborne concentration of asbestos | Required respirator or conditions of use |
|---|--|
| Not to exceed 1 f/cc ($10 \times \text{PEL}$), or otherwise as required independent of exposure pursuant to 29 CFR 1926.1101 (h)(2)(iv) | Half-mask air-purifying respirator, other than a disposable respirator, equipped with high-efficiency filters. |
| Not to exceed 5 f/cc ($50 \times \text{PEL}$) | Full facepiece air-purifying respirator equipped with high-efficiency filters. |
| Not to exceed 10 f/cc ($100 \times \text{PEL}$) | Any powered air-purifying respirator equipped with high-efficiency filters or any supplied air respirator operated in continuous-flow mode. |
| Not to exceed 100 f/cc ($1000 \times \text{PEL}$) | Full facepiece-supplied air respirator operated in pressure-demand mode. |
| Greater than 100 f/cc ($1000 \times \text{PEL}$) or unknown concentration | Full facepiece-supplied air respirator operated in pressure-demand mode and equipped with an auxiliary, positive-pressure, self-contained breathing apparatus. |

All employees who perform Class I work without an NEA in regulated areas where exposures may exceed 1.0 f/cc shall be provided a full facepiece-supplied air respirator that operates in the pressure-demand mode. The respirator shall be equipped with an auxiliary, positive-pressure, self-contained breathing apparatus or a HEPA back-up filtration system. Where monitoring data are available for the required job and indicate that exposures do not exceed 1.0 f/cc, tight-fitting PAP respirators may be used.

Negative-pressure respirators used for protection against asbestos must be fit tested every 6 months, rather than the more usual 12-month refitting schedule.

4.8.2 Protective Clothing

Employees shall use protective clothing (including coveralls or similar whole-body clothing) head coverings, gloves, and foot coverings when performing Class I work, where exposure to airborne concentrations of asbestos exceeding the TWA and/or excursion limit is possible, and when performing large-scale work. Protective clothing may be of the disposable type or may be reusable, and shall never be worn outside the immediate work area.

Clean protective clothing shall be provided at the start of each shift or work session during a shift, whichever comes later, or when redonning used protective equipment is impractical because it is heavily contaminated or cannot be reused.

Generally, personal clothing should not be worn under coveralls. However, form-fitting underwear or bathing suits may be worn if approved by the cognizant industrial hygienist.

4.9 Installation of New ACM

Generally, installation of new ACM in LLNL buildings is prohibited—except if no reasonable alternative material can be used. Installation of ACM in such instances must be approved in writing by the cognizant ES&H team industrial hygienist and the cognizant building manager or facility coordinator.

4.10 Waste Disposal

All friable ACM shall be treated as hazardous waste. Contact the ES&H team environmental analyst or Hazardous Waste Management (HWM) technician to determine the friability of a specific waste. Friable asbestos waste shall be placed in 6-mil-thick plastic bags that are gently squeezed, sealed, and placed in outer plastic bags that are also 6-mil thick. The double-bagged waste shall then be packed in Department of Transportation (DOT) 17H 55-gal drums. Outer containers shall be conspicuously labeled with the DANGER sign in Appendix E (Fig. E-1) and the LLNL hazardous waste label, a copy of which can be found in the *Environmental Compliance Manual*.

Waste generated by LLNL employees or SLO contractors is disposed of through the HWM Division. Disposal of all hazardous asbestos waste generated by outside subcontractors shall be the responsibility of those subcontractors. Written authorization is required from HWM before waste can be shipped offsite for disposal.

4.11 Posting and Labeling

The DANGER sign in Appendix E (Fig. E-1) shall be conspicuously posted on or as close as possible to ACM. ACMs shall be labeled directly; if this is not feasible, a sign such as that in Fig. E-2a (or Fig. E-2b) shall be posted in a convenient location on a wall or by a light switch nearest the northwest corner of a room. A sign such as that in Fig. E-3 shall be posted near principal doorways on buildings that contain ACBM. Regulated areas shall be demarcated with signs that contain the wording specified in Fig. E-4.

Posting at the perimeter of regulated areas need not include an admonition regarding respirators and coveralls if these types of gear are not necessary within the regulated area.

4.12 Operations and Maintenance Program

As a minimum, Plant Engineering shall institute an Operations and Maintenance Plan for ACBM. This plan shall include procedures for

- Surveying structures to locate ACBM and evaluate its condition.
- Labeling ACBM with the appropriate signs, as described in Section 4.11.
- Monitoring identified ACBM for deterioration.
- Repairing or removing damaged ACBM.
- Promptly cleaning up or isolating ACBM spills.
- Properly training Plant Engineering personnel who handle asbestos.
- Keeping accurate records of asbestos removal and repair work.
- Apprising building and facility managers of the location and extent of asbestos in their areas of responsibility.
- Notifying facility managers, building coordinators, and Hazards Control annually of the findings of inspections or of changes that have occurred (e.g., removal, replacement, or repair of ACBM). ACBM shall be resurveyed every three years by Plant Engineering, and the condition of previously identified accessible asbestos shall be checked by facility managers during an annual self-assessment.

4.13 Process for Review of Planned Work

In accordance with the requirements in Chapter 6 of the *Health & Safety Manual*, Hazards Control must review all plans for the demolition, renovation, remodeling, or construction of facilities that may disrupt ACMs. This requirement applies to any such activities conducted by LLNL and SLO personnel and subcontractors.

Written documentation of control measures for the handling of asbestos must be developed and submitted to the ES&H team for review, depending on the size of the job.

4.13.1 Asbestos Work Permit

Asbestos Work Permits are used to document limited-scale asbestos work and are only applicable to work performed by LLNL and SLO personnel. The supervisor is responsible for developing and submitting Work Permits to the ES&H team industrial hygienist 48 hours in advance of the scheduled work, if possible.

Limited-scale work conducted pursuant to an NEA does not require an Asbestos Work Permit.

4.13.2 Operating Procedure (Large-Scale Work)

A safe operating procedure that incorporates relevant sections of the Plant Engineering specifications⁷ shall be prepared by an accredited project designer (see Table 3 in Section 6.0 for criteria). When feasible, operating procedures shall be submitted to the cognizant industrial hygienist at least four weeks in advance of the scheduled work. Subcontractors must submit detailed operating plans in accordance with Plant Engineering specifications.⁷

4.14 Subcontracted Asbestos Work

Subcontractors performing asbestos-related work shall comply with the requirements of Plant Engineering specifications⁷, as applicable, and those in this supplement. Plant Engineering personnel who produce subcontracting documents for asbestos work shall either be accredited as project designers (see Table 3 in Section 6.0 for criteria) or have their work plans and contract documents approved by a Plant Engineering employee who is accredited as a project designer. All work plans and contract documents must be reviewed by the ES&H team.

The organization contracting large-scale asbestos work shall retain a Certified Industrial Hygienist to perform perimeter and clearance monitoring. Unless this organization can provide inspectors who are accredited as asbestos supervisors, the Certified Industrial Hygienist shall also be required to perform health and safety oversight on the project.

Many construction subcontracts involve incidental asbestos work. For example, installing a new trailer may involve “splicing” into an asbestos cement water pipe. Such work should be identified before the contract is sent out for bid, and should either be addressed in the specifications or arrangements should be made for the work to be done by in-house personnel. As part of the design review process, this aspect of the project must be detailed in the submittal provided to Hazards Control.

5.0 Responsibilities

This section describes the general responsibilities for LLNL organizations and employees who perform asbestos-related work. Specific responsibilities are also provided for organizations within LLNL with key asbestos safety roles.

5.1 Plant Engineering Department

Plant Engineering shall

- Appoint an Asbestos Operations and Maintenance Program Officer to serve the Laboratory. This officer shall implement and oversee the LLNL Operations and Maintenance Program and receive training as an AHERA Certified Supervisor, Certified Building Inspector, and Certified Project Designer.
- Perform initial labeling and posting of ACBM.
- Maintain and update a site-wide ACBM database that includes changes and modifications.
- Annually provide facility managers and building managers an updated list of ACBM within their facilities.
- Resurvey ACBM every three years.

5.1.1 Plant Engineering Training Officer

The Plant Engineering training officer shall maintain training records for each Plant Engineering employee trained to perform any type of asbestos-related work. The officer shall also ensure that the asbestos training employees receive from outside vendors meets applicable requirements of both OSHA and EPA regulations.

5.1.2 Supervisors

Supervisors of employees who perform asbestos-related work shall

- Provide appropriately trained workers (see Table 3 in Section 6.0 for criteria) to conduct Class III and Class IV asbestos work. Other classes of asbestos work may be conducted by Plant Engineering personnel if they meet all requirements for the particular class of work.

- Ensure that an Asbestos Work Permit, Operation Plan, or NEA is prepared, and that the document is reviewed and approved by a Hazards Control industrial hygienist before starting asbestos-related work.
- Ensure that work practices comply with this supplement. In addition,
 - Approve the set up of the NPE or other asbestos work containment.
 - Ensure that the containment remains intact and is effective.
 - Control entry and exit from the site.
 - Assure the proper use of personal protective clothing and any decontamination facilities and procedures.
- Ensure that engineering controls (e.g., ventilation equipment, HEPA vacuum cleaners, and water sprayers assigned to specific locations) work properly and are tested when appropriate.
- Ensure that personnel receive medical evaluations, as specified in this supplement.
- Ensure that large-scale work carried out by Plant Engineering personnel is done in accordance with Plant Engineering specifications.⁷ This includes having design work performed by an accredited project designer; submitting a complete Operation Plan, equipment list, and proposed personnel to the ES&H team for review; and contracting with a Certified Industrial Hygienist to provide air monitoring.
- Ensure that friable ACM and contaminated items are disposed of as hazardous waste through the HWM Division.

5.1.3 Construction Project Manager/Designer

The construction project manager or designer shall

- Participate in the subcontracting process for asbestos-related work, and ensure that subcontractors are qualified in accordance with the requirements in this supplement and the Plant Engineering specifications.⁷
- Ensure that subcontracting documents are prepared or reviewed by a project team member who is a certified project designer (see Table 3 in Section 6.0 for criteria).
- Maintain training as a project designer or have a Plant Engineering representative who is a certified project designer as part of the construction team.
- Ensure that plans for subcontracted asbestos-related work are reviewed and approved by Hazards Control.
- Verify that the subcontractor has notified the Bay Area or San Joaquin Area Air Quality Management District appropriately.
- Arrange to have the worksite inspected to ensure that the contractor performs work in accordance with contract specifications.

- On large-scale subcontracted asbestos abatement worksites, either retain a Certified Industrial Hygienist or make special arrangements with Hazards Control to perform asbestos safety and health oversight of perimeter and clearance monitoring.

5.2 Hazards Control Department

Hazards Control shall

- Provide one or more staff members who are trained in accordance with the requirements in 40 CFR 763 and accredited as Certified Supervisors, Building Inspectors, and Project Managers (see Table 3 in Section 6.0 for criteria).
- Monitor asbestos exposure of Laboratory employees and employees who work on limited-scale work under supplemental labor contracts.
- Conduct initial and periodic monitoring as required.
- Notify supervisors of the air-sampling results of affected employees.
- Monitor the perimeter of the area where limited-scale asbestos work is being conducted by LLNL or SLO personnel, as required.
- Maintain records of monitoring indefinitely.
- Review operations to ensure compliance with applicable regulations.
- Provide
 - Services to identify ACM through optical microscopy; maintain records of these analyses.
 - Exposure assessment consultation for historically reported potential exposures.
 - Health Services with the air monitoring results for all employees exposed at the action level and/or requiring medical surveillance.
 - SLO employers the air monitoring results for their employees.
- Test LLNL-owned vacuum cleaners, HEPA filters, exhaust hoods, and other engineering controls to ensure they function in accordance with regulations, standards of good industrial practice, or the manufacturer's specifications.
- Review plans, specifications, and procedures for asbestos-related work for compliance with regulations, policy, and best management practice; and review submittals for large-scale asbestos work.
- Provide respirators and guidance for the selection of respirators and other PPE to LLNL and SLO employees. Fit-test respirators in accordance with applicable OSHA requirements.
- Complete and approve Asbestos Work Permits and Operation Plans started by Plant Engineering; conduct pre-work inspections of Plant Engineering asbestos jobs.

- Review triennial surveys of ACM conducted by Plant Engineering, including annual inspections of ACM conducted by facility managers and building coordinators. Notify the respective organizations of deficiencies or omissions to be addressed.
- Notify facility managers and building coordinators when Hazards Control personnel find new ACBM.
- Provide training to employees who may incidentally encounter asbestos. (See Table3 in Section 6.0 for details.)
- Conduct post-work inspections and collect clearance air samples after LLNL or SLO employees have performed limited-scale asbestos-related work.
- Approve (or disapprove) the removal of engineering controls based on the results of clearance samples and visual inspections.
- Develop NEAs for repetitive operations.
- Review the work performed by consultants on asbestos worksites.

5.3 Health Services Department

Health Services shall

- Consult with Hazards Control professionals and supervisors on the need for medical surveillance of individuals and groups.
- Ensure that clinicians are available to answer medical questions or other health concerns employees may have.
- Provide employees medical surveillance, as required by 29 CFR 1926.1101.
- Maintain employees' medical records indefinitely.
- Review and provide consultation on reports of historical exposure.
- Provide medical approval for respirators.
- Inform employees of the results of examinations and communicate any restrictions to employees and their supervisors.

5.4 Environmental Protection Department

When required, the Environmental Protection Department (EPD) shall

- Notify the Bay Area or San Joaquin (Site 300) Air Quality Management District of pending asbestos-related renovation and maintenance work as well as planned demolition work, regardless of the asbestos content of the structure.
- Ensure that friable asbestos waste turned over to the HWM Division is properly handled and disposed of as hazardous waste.
- Determine if a particular asbestos-containing waste is deemed "hazardous" for purposes of disposal.

5.5 Facility Managers and Building Coordinators

5.5.1 Facility Managers

Facility managers shall

- Be aware of locations identified by Plant Engineering and Hazards Control as having ACBM.
- Promptly report to Hazards Control those areas where the ACBM is damaged or deteriorating.
- Maintain copies of inspection records, survey reports, and assessment findings related to asbestos in the facility.

5.5.2 Building Coordinators

Building coordinators shall

- Maintain oversight of identified ACBM and respond to incidents involving asbestos release.
- Assist Plant Engineering and Hazards Control in surveying buildings for ACBM.
- Limit access to potentially hazardous, asbestos-containing areas.
- Promptly arrange for the repair or replacement of deteriorated or damaged ACBM.
- Call the area health and safety technician for assistance upon learning of a potential or actual asbestos problem.
- If the identity of the spilled material is unknown, call the area ES&H team to collect a sample for analysis.
- Limit access to asbestos work areas. Assist Plant Engineering and Hazards Control in providing safe working conditions for building occupants, and Plant Engineering and subcontract personnel during asbestos work.
- Replace asbestos warning signs that have been removed or defaced.
- Ensure that proper controls are used for maintenance or renovation activities that disturb ACM.
- Approve the installation of any asbestos-containing item within your area of cognizance.

6.0 Training

The training requirements for each group below are specified in Table3.

- Supervisors (competent persons)—Individuals who plan and manage asbestos work.
- Asbestos workers—Employees who conduct asbestos work.

Table 3. Training requirements for asbestos-related work. NOTE: Only course HS4420 is offered by the Laboratory. The other courses are required by the State of California, and arrangements must be made to take these courses from certified vendors.

| Course title/length | Content | Who should attend | Annual refresher |
|--|---|---|------------------|
| Asbestos Safety (HS4420)—1–2 hr | General asbestos awareness, health effects, and LLNL policy | Anyone who may incidentally come in contact with asbestos, any interested employee, and Hazards Control health and safety technicians | No. |
| Worker (Class I and II work)—32 hr | Handling asbestos in buildings and on equipment, up to large-scale work | Plant Engineering and other personnel | Yes. 8 hr |
| Class III work—16 hr | Handling asbestos in maintenance and operations | Plant Engineering personnel | Yes. 8 hr |
| Class IV work—2–4 hr | Cleaning minor asbestos contamination | Plant Engineering and other personnel | Yes. 2 hr |
| Supervisor—Class I and II work—40 hr | Supervision of Class I and II asbestos work | Supervisors of personnel who perform this work, Plant Engineering Operations and Management Officer, industrial hygienist (at least 1), and construction inspectors assigned to worksites where large-scale asbestos is removed | Yes. 8 hr |
| Class III work—16 hr | Supervision of employees performing this work | " | Yes. 8 hr |
| Project designer (certified designer) ^a —24 hr | Procedures to plan, contract for, and conduct full-scale asbestos work | Project managers, construction managers, and construction estimators involved in large-scale asbestos work; Plant Engineering Operations and Management Officer, and industrial hygienist (at least 1) | Yes. 8 hr |
| Building inspector (certified inspector) ^a —24 hr | Procedures to survey buildings to identify ACBM | Personnel who survey buildings to identify ACBM, Plant Engineering Operations and Management Officer, and industrial hygienist (at least 1) | Yes. 8 hr |
| Job-specific training—time varies | Tailored to non-building or unusual work | Anyone involved in asbestos work that does not fit other categories | No. |

^a Training content to meet requirements of 49 CFR 763.

- Asbestos project designers—Individuals who prepare operating plans for large-scale work or contract specifications for subcontracted asbestos work of any type.
- Building inspectors—Individuals who survey buildings to identify ACBM.
- Others—People who may have incidental contact with ACM.

All training, except course HS4420 (Asbestos Safety), should be provided by a training center accredited by the State in accordance with 49 CFR 763. Contact the cognizant ES&H team industrial hygienist for information on the availability of training facilities and classes.

7.0 LLNL Contacts

For additional information and guidance regarding this supplement, contact the following as necessary:

- Plant Engineering Operations and Maintenance Officer, ext. 3-1864—Results of asbestos survey.
- Area ES&H team—Asbestos identification and hazard evaluation.
- Plant Engineering, ext. 2-9444—Repair or removal of ACM.
- Environmental analyst or HWM technician—Status of waste material.
- Hazards Control Training and Safety Analysis Group, ext. 2-5263—Course HS4420.
- ES&H team—General information.
- Plant Engineering Training Office, ext. 2-9097—Training for Plant Engineering personnel.
- Health Services, ext. 2-7459; Appointment scheduling, ext.2-7462.

8.0 References

1. The National Fire Protection Agency, *Standard Methods of Fire Tests for Flame-Resistant Textiles and Films*, NFPA 701, Washington, DC (latest edition).
2. The National Institute of Building Sciences, *Guidance Manual: Asbestos Operations and Maintenance Work Practices*, NIBS, Washington DC (1992).
3. National Institute of Occupational Safety and Health, *Manual of Analytical Methods*, "7400 method," NOISH, 84-100 (latest edition).

4. Occupational Safety and Health Administration, Analytical Method, OSHA ID 160, Salt Lake City, UT (latest edition).
5. Code of Federal Regulation, Title 40, Part 763, "EPA Asbestos Hazard Emergency Response Act (AHERA).
6. Yamate, G., et al. *Methodology for the measurement of airborne asbestos by electron microscopy*, Contract Number 68-02-3266, Washington, DC (July 1984).
7. Plant Engineering Asbestos Contracting Specifications 01310–01319 (latest edition).

Supporting Standards

California Code of Regulation, Title 8, Chapter 1529, "Asbestos Standard for the Construction Industry."

Code of Federal Regulations, Title 29, Part 1926.1101, "Asbestos Standard for the Construction Industry."

Code of Federal Regulation, Title 40, Part 61(M), "EPA National Emission Standards for Hazardous Air Pollutants (NESHAPS)."

Bay Area Air Quality Management District, Regulation 11, Rule 2, "Asbestos."

Appendix A

Terms and Definitions

| | |
|--|--|
| AHERA | Asbestos Hazard Emergency Response Act of 1986. Amended in 1990. |
| asbestos | Six fibrous magnesium silicate minerals: chrysotile, crocidolite, amosite, and the fibrous forms of actinolite, tremolite and anthophyllite. |
| asbestos-containing building material (ACBM) | Construction materials containing more than 0.1% of asbestos installed inside buildings or other structures or in attached, covered walkways. |
| asbestos-containing material (ACM) | Any material, naturally occurring or manufactured, that contains more than 0.1% of asbestos by weight. |
| asbestos-related work | Any work involving an ACM that may result in the release of any quantity of asbestos fibers into the air. |
| asbestos work permit | A form (see Appendix D) used to plan and coordinate limited-scale asbestos-related work. It describes the manner in which the work will be conducted, and is initiated by a supervisor (or competent person), and completed and signed by an industrial hygienist. |
| certified industrial hygienist | An industrial hygienist certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene. |
| class I asbestos work | Refers to activities involving the removal of thermal system insulation (TSI) and surfacing ACM. |
| class II asbestos work | Refers to activities involving the removal of ACM that is not TSI or surfacing material. This includes, but is not limited to the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics. |

| | |
|--|--|
| class III asbestos work | Refers to repair and maintenance operations where ACM, including TSI and surfacing material, is likely to be disturbed. |
| class IV asbestos work | Refers to maintenance and custodial activities during which employees can come in contact with ACM, including activities to clean up waste and debris containing ACM. |
| critical barriers | A positive means to prevent fiber migration. |
| demolition | Wrecking or removing any load-bearing element in a structure. |
| friable | Any material that can be reduced to a powder by applying hand pressure. |
| glove bag | A plastic sack designed to enclose the asbestos being disturbed. It allows personnel access via built-in gloves. |
| high-efficiency (HEPA) filter particulate air | A filter capable of removing 99.97% or greater of a monodisperse aerosol having a mean diameter of 0.3 μm . |
| large-scale asbestos work | All Class I work involving more than 25 lineal feet or 10 ft^2 of ACM and Class II work involving more than 500 ft^2 of ACM. |
| limited-scale asbestos work | Class I work involving the removal of less than 25 lineal feet or 10 ft^2 of ACM; Class II work involving less than 500 ft^2 of ACM; all removal of vinyl asbestos tile; and all Class III and IV work. |
| medical surveillance | An evaluation of a worker's ability and suitability to perform asbestos-related work and wear a respirator. This typically includes an examination; a medical and work history; tests deemed necessary by the examining physician; a review of information from previous medical exams and exposure-monitoring results, if available; and a written opinion of the results. Surveillance is to begin before initial assignment and continues at least annually thereafter. |

| | |
|--|---|
| mini-enclosures | A small walk-in enclosure that accommodates no more than two persons. A mini-enclosure may be used if the material being disturbed or removed can be completely contained by the enclosure. |
| negative exposure assessment (NEA) | A demonstration based on representative monitoring data from prior operations that worker's asbestos exposures are expected to be consistently below the 8-hour and 30-minute permissible limits. |
| negative pressure enclosure (NPE) | An enclosure of any configuration, as long as it maintains at least 4 air changes per hour (6 air changes recommended) and has a minimum of -0.02 column in. of water pressure differential (-0.05 column in. recommended), relative to outside pressure, as evidenced by continuous manometric measurements with a continuous data-recording system. |
| operations and maintenance (O&M) program | A program designed to minimize the exposure of occupants within a building or area to asbestos fibers resulting from damaged or deteriorating ACBM. |
| PACM | Presumed asbestos-containing material. Building materials, including but not limited to thermal system insulation and surfacing material, that may contain asbestos but have not yet been tested. |
| regulated area | Any area where airborne asbestos levels may exceed the PEL or excursion limit. A regulated area include areas where unprotected personnel may be exposed to asbestos at levels above the clearance limits. Physical barriers (e.g., temporary enclosures or conspicuous barriers such as cones and warning tape) are used to demarcate the area to prevent unqualified and unprotected persons from entering. |
| remediation | Any asbestos-related job carried out specifically to correct an asbestos hazard. |
| renovation | Work, other than demolition, in which ACM is moved or stripped from any part of a structure. |

room responsible
person

The individual responsible for experiments or programmatic activities conducted in a room or area.

spill (ACM)

An accidental release of asbestos from ACM.

surfacing ACM

Construction ACM that was applied on the surface of buildings wet and allowed to dry or cure in place. This includes structural fireproofing, acoustic or decorative ceilings, and wallboard taping and texturing compounds.

thermal system
insulation

Asbestos-containing material applied to pipes, fittings, boilers, breaching, tanks, ducts, or other structural components to prevent heat loss or gain.

Appendix B

Common ACMs and ACBMs

B.1 Asbestos-Containing Materials

Listed below are common types of equipment and products that contain asbestos material.

- Electrical insulation in ovens, furnaces, and other heat-producing systems.
- Clutches and brake shoes in vehicles and other equipment.
- Heat-resistant clothing, such as gloves or aprons.
- Laboratory glassware wrap and insulation.
- Asbestos cement board and Transite in fume hoods, laboratory bench tops, trays, welding and soldering benches, furnaces, and ovens.
- Gasket material for pipes, ducts, and other equipment.
- Older welding blankets and fire blankets.
- Packing for electrical conduit and pipes.
- Specialized adhesives.
- Older electrical wire insulation.

B.2 Asbestos-Containing Building Materials

Common asbestos-containing building materials are

| | |
|---------------------------|-------------------------|
| Acoustic ceilings | Mastics, glue |
| Asbestos board | Sheet rock |
| Asbestos cement pipe | Pipe fittings |
| Asbestos shingles | Pipe gaskets |
| Boiler insulation | Pipe insulation |
| Caulking putties | Plaster |
| Ceiling tiles | Roof felt |
| Duct insulation | Roofing paint |
| Duct tape | Roof patch |
| Electrical insulation | Sheet-rock tape |
| Fire curtains | Structural fireproofing |
| Floor tiles | Stucco |
| Heat-resistant insulation | Textured paint |
| Joint compound | Transite panels |
| Linoleum | Waterproof membrane |
| Packing | |

Appendix C

Process for Limited-Scale Asbestos Work

Limited-scale asbestos work is defined as Class I work involving less than 25 lineal feet or 10 ft² of ACM, Class II work involving less than 500 ft² of ACM, the removal of vinyl asbestos tile, or any Class III or IV asbestos work. This appendix outlines the general requirements and flow of activities for limited-scale asbestos work conducted by Plant Engineering or SLO employees. Unless otherwise specified, the supervisor of the asbestos work crew is the responsible for all actions.

C.1 Competent Person (PE Supervisor) Reviews Work

- Does the work exceeds limited scale? ☐ Yes. This appendix does not apply.
- ☐ No. Respond to the remaining questions.
- Is the work covered by an NEA? ☐ Yes. Proceed as required by the NEA.
- ☐ No. Initiate an Asbestos Work Permit.

C.2 Industrial Hygienist Reviews Work

- Is medical surveillance required? ☐ Yes.
- ☐ No.
- Is a work permit acceptable? ☐ Yes. The industrial hygienist (IH) must sign the permit.
- ☐ No. The IH notifies the supervisor of deficiencies. Changes are made as necessary before the IH signs the permit.

C.3 Planned Work

- Is sampling required? ☐ Yes. Notify the IH 3 days in advance.
- ☐ No. Notify the IH 1 day in advance.
- Is work to be performed in building? ☐ Yes. Notify the building manager/facility coordinator.

☐ No.

Is work to be performed on a Type A or B roof?

☐ Yes. Notify the building manager and negotiate time to do work. A Roof Access Permit is required.

☐ No.

Does the work involve demolition?

☐ Yes. Notify the environmental analyst for air quality district notification.

☐ No.

Does the work involve renovation?

☐ Yes. Evaluate the need for EPD notification.

☐ No.

C. 4 Worksite Set Up

To set up the worksite, employees shall

- Post the appropriate signs.
- Install critical barriers (as specified).
- Cover surfaces.
- Install specified ventilation system.
- Provide HEPA-filtered vacuum system(s).
- Install specified control systems (NPE, glove bag, etc.) and decontamination systems.

Supervisors shall inspect the control and decontamination of systems.

C.5 Work Procedures

The supervisor shall

- Ensure that medical surveillance is completed, if needed.
- Verify that all personnel receive the required training.
- Obtain the specified types of respirators.
- Inspect the worksite at least daily.
- Provide a minimum of 2 persons for most types of work.
- Contact the industrial hygienist if final visual inspection or clearance sampling is specified.
- Remove any critical barriers, postings, and ventilation systems only after the industrial hygienist has approved such removal based on inspection and air samples.

Employees shall

- Wet material before and during removal.
- Maintain good housekeeping.
- Completely contain waste as it is generated.
- Remove ACM in large segments as is feasible.
- Minimize breakage, pulverizing, or damage to ACM.
- Use glove bags properly (single use; exhaust before removal; water, as needed).
- Decontaminate the area, vacuum surfaces, and remove surface covers.

C.6 Recordkeeping

The Plant Engineering Asbestos Operations Manager shall be notified of all asbestos removed from buildings or equipment.

To be completed by the LLNL crew supervisor. Outside contractors should use PE Specification 001310

Supervisor's name _____ WHIZ TAG # _____ PFN # _____ JO# _____

Affected building: _____ Room/area: _____

Is area occupied? ☐ Yes ☐ No Will work area be posted before start of work? ☐ Yes ☐ No

Brief job description: _____

Planned work dates: from _____ to _____ Time: from _____ to _____

| Activity to be performed | Measured Quantity: |
|---|--------------------|
| Thermal System Insulation (TSI) removal | _____ LF/SF |
| Thermal System Insulation (TSI) encapsulation | _____ LF/SF |
| Transite panel or pipe removal | _____ LF/SF |
| Vinyl asbestos tile (VAT)/mastic removal | _____ SF |
| Linoleum removal | _____ SF |
| Acoustic or fireproofing removal | _____ SF |
| Cleaning or decontamination of surfaces | _____ SF |
| Sawing, drilling, scoring, or breaking of asbestos | _____ SF |
| Other (Describe project on back of this sheet) | _____ LF/SF |
| Type of Asbestos (chrysotile, amosite, crocidolite): _____ % Asbestos _____ | File # _____ |

Individuals involved in activity

| Name | Employee # | Training Hrs. | Name | Employee # | Training Hrs. |
|------|------------|---------------|------|------------|---------------|
| | | | | | |
| | | | | | |
| | | | | | |

Asbestos Control Equipment

| | | | |
|--|--|---|--|
| HEPA vacuums | <input type="checkbox"/> Yes <input type="checkbox"/> No | Amended water | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Encapsulant (name _____) | <input type="checkbox"/> Yes <input type="checkbox"/> No | Glove bags | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Mastic remover (name _____) | <input type="checkbox"/> Yes <input type="checkbox"/> No | Bridging (name _____) | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| HEPA-filtered negative air | <input type="checkbox"/> Yes <input type="checkbox"/> No | Estimated neg-air CFM? _____ | Qty _____ |
| Decon chamber <input type="checkbox"/> Yes <input type="checkbox"/> No | Decon type? _____ | Shower <input type="checkbox"/> Yes <input type="checkbox"/> No | |

Waste Disposal Arrangements

1. Is this a demolition? ☐ Yes ☐ No
2. Are the material conditions friable or likely to become friable? ☐ Yes ☐ No
3. If the response to step 2 is "Yes," are regulated quantities of friable asbestos greater than 100 LF, 100 SF, 35 ft³ ☐ Yes ☐ No

Air Monitoring

Notify the industrial hygienist at least 48 hours before start of work so arrangements can be made for air monitoring, which is required by 8 CCR 1529J.

Supervisor's signature _____ Date: ____/____/____

To be completed by the EPD/PRAG Group (ext. 3-5789 or 2-2750; fax 3-5490)

1. If the response to steps 1, 2 and 3 above is "No," then the notification is processed through HC industrial hygienist.
2. If you answered "Yes" to step 1 or 3 above, then EPD must file notification more than 10 days prior to job start date.

EPD/PRAG signature (if required) _____ Date: ____/____/____

To be completed by the industrial hygienist

Personal Protective Equipment

| | |
|--------------------------------------|------------------------|
| Coveralls: Tyvek TM _____ | Other (Specify): _____ |
| Eye Protection _____ | Shoe Covers _____ |
| Hearing Protection _____ | Hard Hats _____ |
| Gloves _____ | Hard Hats _____ |

Respirator Protection Requirements

Issue Point Administrator (if other than Supervisor) _____

| | |
|---|-----------------|
| Half Mask _____ | Full Face _____ |
| PAPR (full face piece) _____ | Other _____ |
| Cartridge type if other than HEPA _____ | Comments _____ |

Additional Control Requirements/Procedures: _____

Industrial hygienist's signature _____ Date: ____/____/____

Industrial hygienist name _____ Pager # _____ Phone # _____ FAX # _____

Appendix D

Asbestos Work Permit

This appendix contains a sample Asbestos Work Permit, which is used to document limited-scale asbestos work and is only applicable to work performed by LLNL and SLO personnel.

Asbestos Work Permit

To be completed by the LLNL crew supervisor. Outside contractors should use PE Specification 001310

Supervisor's name _____ WHIZ TAG # _____ PFN # _____ JO# _____

Affected building: _____ Room/area: _____

Is area occupied? ☐ Yes ☐ No Will work area be posted before start of work? ☐ Yes ☐ No

Brief job description: _____

Planned work dates: from _____ to _____ Time: from _____ to _____

Activity to be performed _____ Measured Quantity: _____

Thermal System Insulation (TSI) removal _____ LF/SF

Thermal System Insulation (TSI) encapsulation _____ LF/SF

Transite panel or pipe removal _____ LF/SF

Vinyl asbestos tile (VAT)/mastic removal _____ SF

Linoleum removal _____ SF

Acoustic or fireproofing removal _____ SF

Cleaning or decontamination of surfaces _____ SF

Sawing, drilling, scoring, or breaking of asbestos _____ SF

Other (Describe project on back of this sheet) _____ LF/SF

Type of Asbestos (chrysotile, amosite, crocidolite): _____ % Asbestos _____ File # _____

Individuals involved in activity

| Name | Employee # | Training Hrs. | Name | Employee # | Training Hrs. |
|------|------------|---------------|------|------------|---------------|
| | | | | | |
| | | | | | |

Asbestos Control Equipment

HEPA vacuums ☐ Yes ☐ No Amended water ☐ Yes ☐ No

Encapsulant (name _____) ☐ Yes ☐ No Glove bags ☐ Yes ☐ No

Mastic remover (name _____) ☐ Yes ☐ No Bridging (name _____) ☐ Yes ☐ No

HEPA-filtered negative air ☐ Yes ☐ No Estimated neg-air CFM? _____ Qty _____

Decon chamber ☐ Yes ☐ No Decon type? _____ Shower ☐ Yes ☐ No

Waste Disposal Arrangements

1. Is this a demolition? ☐ Yes ☐ No

2. Are the material conditions friable or likely to become friable? ☐ Yes ☐ No

3. If the response to step 2 is "Yes," are regulated quantities of friable asbestos greater than 100 LF, 100 SF, 35 ft³ ☐ Yes ☐ No

Air Monitoring

Notify the industrial hygienist at least 48 hours before start of work so arrangements can be made for air monitoring, which is required by 8 CCR 1529J.

Supervisor's signature _____ Date: ____/____/____

To be completed by the EPD/PRAG Group (ext. 3-5789 or 2-2750; fax 3-5490)

1. If the response to steps 1, 2 and 3 above is "No," then the notification is processed through HC industrial hygienist.

2. If you answered "Yes" to step 1 or 3 above, then EPD must file notification more than 10 days prior to job start date.

EPD/PRAG signature (if required) _____ Date: ____/____/____

To be completed by the industrial hygienist

Personal Protective Equipment

Coveralls: TyvekTM _____ Other (Specify): _____

Eye Protection _____ Shoe Covers _____

Hearing Protection _____ Hard Hats _____

Gloves _____ Hard Hats _____

Respirator Protection Requirements

Issue Point Administrator (if other than Supervisor) _____

Half Mask _____ Full Face _____

PAPR (full face piece) _____ Other _____

Cartridge type if other than HEPA _____ Comments _____

Additional Control Requirements/Procedures: _____

Industrial hygienist's signature _____ Date: ____/____/____

Industrial hygienist name _____ Pager # _____ Phone # _____ FAX # _____

Appendix E
Signs and Labels

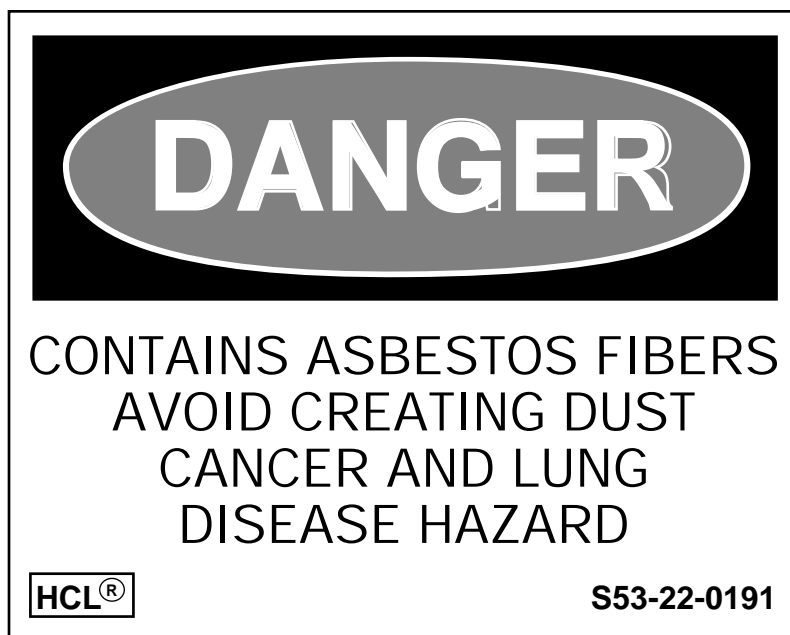


Figure E-1. Sign for use with asbestos-containing materials and containers.

ASBESTOS IS PRESENT IN B- _____ R- _____
 UNDAMAGED ASBESTOS IS NOT A HEALTH RISK

DO NOT DISTURB THE ITEMS MARKED BELOW:

| <u>MATERIAL</u> | <u>LOCATION</u> |
|---|-----------------|
| <input type="checkbox"/> FLOOR TILES / LINOLEUM | _____ |
| <input type="checkbox"/> ADHESIVE FOR TILES / LINOLEUM | _____ |
| <input type="checkbox"/> PIPE INSULATION-ELBOWS / STRAIGHTS / FITTINGS | _____ |
| <input type="checkbox"/> ASBESTOS-CEMENT BOARD | _____ |
| <input type="checkbox"/> DUCT INSULATION | _____ |
| <input type="checkbox"/> CEILING / WALL(S) | _____ |
| <input type="checkbox"/> ROOFING MATERIALS | _____ |
| <input type="checkbox"/> OTHER | _____ |
| <input type="checkbox"/> OTHER | _____ |
| <input type="checkbox"/> OTHER | _____ |

FOR FURTHER INFORMATION REGARDING ASBESTOS PRODUCTS IN
 THIS AREA, CONTACT THE BUILDING COORDINATOR. REPORT ANY
 DAMAGE TO THESE MATERIALS TO HAZARDS CONTROL IMMEDIATELY.



SOME MATERIALS IN THIS ROOM
 CONTAIN ASBESTOS FIBERS.
 AVOID CREATING DUST.
 POTENTIAL CANCER/LUNG DISEASE HAZARD.

PLEASE DO NOT REMOVE, CONCEAL OR MODIFY THIS SIGN.
IF THIS SIGN IS DAMAGED RETURN IT TO ASBESTOS PROJECT MANAGER, L607

Revised 16 September 1991-DB/DH

Figure E-2a. Room sign for use where ACM is present.

| N O T I C E | |
|--|-------------------|
| Asbestos is present in B-_____R- _____ | |
| <u>UNDAMAGED</u> ASBESTOS IS <u>NOT</u> A HEALTH RISK | |
| Do not disturb the items marked below: | |
| Material | Location comments |
| <input type="checkbox"/> Floor tiles | _____ |
| <input type="checkbox"/> Tile adhesive | _____ |
| <input type="checkbox"/> Other | _____ |
| Please do not remove. If this sign is damaged, return it to Asbestos Project Manager, L-607. | |
| For further information regarding asbestos products in this area, contact the building coordinator. Report damage to these materials to the Hazard Control ES&H Team immediately. | |
| Revised: 25 April 1994, DB/DR | |

Figure E-2b. Alternative room sign for use where undamaged, encapsulated, or nonfriable asbestos is present.

ASBESTOS-CONTAINING MATERIALS NOTIFICATION

NOTIFICATION TO ALL EMPLOYEES, OCCUPANTS, CONTRACTORS, AND OTHER PERSONS ENTERING _____. An asbestos survey has been conducted and it confirms the presence of asbestos-containing materials (ACM) in this facility. Any persons authorized to enter this facility may review the results of the asbestos survey. All asbestos-related data will be available from the building coordinator during normal business hours in room _____, ext. _____.

| ASBESTOS IS PRESENT IN THE FOLLOWING ITEMS AND AREAS | |
|--|-----------------|
| <u>Material</u> | <u>Location</u> |
| <input type="checkbox"/> Textured Ceiling | _____ |
| <input type="checkbox"/> Textured Walls | _____ |
| <input type="checkbox"/> Linoleum /Floor Tiles | _____ |
| <input type="checkbox"/> Pipe Insulation | _____ |
| <input type="checkbox"/> Structural Fire Proofing | _____ |
| <input type="checkbox"/> Asbestos-Cement Board | _____ |
| <input type="checkbox"/> Other _____ | _____ |
| <input type="checkbox"/> Other _____ | _____ |

DO NOT DISTURB THESE MATERIALS. FOR FURTHER INFORMATION REGARDING ASBESTOS PRODUCTS IN THIS AREA, CONTACT THE BUILDING COORDINATOR. REPORT ANY DAMAGE TO THESE MATERIALS TO HAZARDS CONTROL IMMEDIATELY.

Asbestos is a substance known to cause respiratory diseases and cancer. It is important for all persons to follow proper practices to minimize the potential for disturbing ACM. Avoid touching asbestos materials on walls, ceilings, pipes, or boilers. Do not drill holes or hang objects from ceilings made of ACM. If you find ACM that has been damaged, report it to your supervisor. Do not disturb damaged asbestos material/debris or suspected asbestos material/debris. Only properly trained and authorized persons may perform any work that may disturb ACM. ACM poses no threat to your health unless asbestos fibers become airborne because of material aging, deterioration, or damage.

If you have any questions or need additional information, contact the building coordinator or the LLNL Asbestos Project Manager at extension 3-1864.

Building Coordinator

Figure E-3. Building entrance sign for use where asbestos-containing material is present.



ASBESTOS

**CANCER AND LUNG DISEASE
HAZARD**

KEEP OUT

**AUTHORIZED
PERSONNEL ONLY**

**RESPIRATORS AND
PROTECTIVE CLOTHING
ARE REQUIRED IN
THIS AREA.**

Figure E-4. Sign for use in regulated asbestos areas.